BIG LOST RIVER WATERSHED SUBBASIN ASSESSMENT AND TMDL

Final

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Abbreviations, Acronyms, and Symbols

§303(d)	Refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired waterbodies required by this section
µ	micro, one-one thousandth
§	Section (usually a section of federal or state rules or statutes)
ADB	assessment database
AWS	agricultural water supply
BAG	Basin Advisory Group
BLM	United States Bureau of Land Management
BMP	best management practice
BOD	biochemical oxygen demand
BOR	United States Bureau of Reclamation
Btu	British thermal unit
BURP	Beneficial Use Reconnaissance Program
C	Celsius
cfu	colony forming units
CFR	Code of Federal Regulations (refers to citations in the federal administrative rules)
cfs	cubic feet per second
cm	centimeters
CWA	Clean Water Act
CWAL	cold water aquatic life
CWE	cumulative watershed effects
DEQ	Department of Environmental Quality
d	day
DO	dissolved oxygen
DOI	U.S. Department of the Interior
DWS	domestic water supply
EMAP	Environmental Monitoring and Assessment Program
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
F	Fahrenheit
FPA	Idaho Forest Practices Act
FWS	U.S. Fish and Wildlife Service
GIS	Geographical Information Systems
HUC	Hydrologic Unit Code
I.C.	Idaho Code
IDAPA	Refers to citations of Idaho administrative rules

IDFG Idaho Department of Fish and Game

IDL Idaho Department of Lands

IDWR Idaho Department of Water Resources

INFISH The federal Inland Native Fish Strategy

IRIS Integrated Risk Information System

km kilometer

km^2 square kilometer

LA load allocation

LC load capacity

m meter

m^3 cubic meter

mi mile

mi^2 square miles

MBI macroinvertebrate index

MGD million gallons per day

mg/L milligrams per liter

mm millimeter

mo month

MOS margin of safety

MRCL multiresolution land cover

MWMT maximum weekly maximum temperature

n.a. not applicable

NA not assessed

NB natural background

nd no data (data not available)

NFS not fully supporting

NPDES National Pollutant Discharge Elimination System

NRCS Natural Resources Conservation Service

NTU nephlometric turbidity unit

ORV off-road vehicle

ORW Outstanding Resource Water

PACFISH The federal Pacific Anadromous Fish Strategy

PCR primary contact recreation

PFC proper functioning condition

ppm part(s) per million

QA quality assurance

QC quality control

RBP rapid bioassessment protocol

RDI DEQ's river diatom index

RFI DEQ's river fish index

RHCA riparian habitat conservation area

RMI DEQ's river macroinvertebrate index

RPI DEQ's river physiochemical index

SBA subbasin assessment

SCR secondary contact recreation

SFI DEQ's stream fish index

SHI DEQ's stream habitat index

SMI DEQ's stream macroinvertebrate index

SRP soluble reactive phosphorus

SS salmonid spawning suspended sediment

SSOC stream segment of concern

STATSGO State Soil Geographic Database

TDG total dissolved gas

TDS total dissolved solids

T&E threatened and/or endangered species

TIN total inorganic nitrogen

TKN total Kjeldahl nitrogen

TMDL total maximum daily load

TP total phosphorus

TS total solids

TSS total suspended solids

t/y tons per year

U.S. United States

U.S.C. United States Code

USDA United States Department of Agriculture

USDI United States Department of the Interior

USFS United States Forest Service

USGS United States Geological Survey

WAG Watershed Advisory Group

WBAG *Waterbody Assessment Guidance*

WBID waterbody identification number

WET whole effluence toxicity

WLA wasteload allocation

WQLS water quality limited segment

WQMP water quality management plan

WQRP water quality restoration plan

WQS water quality standard

Executive Summary

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the CWA are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize waterbodies that are water quality limited (i.e., waterbodies that do not meet water quality standards). States and tribes must periodically publish a priority list of impaired waters, currently every two years. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses the waterbodies in the Big Lost River Subbasin that have been placed on what is known as the "§303(d) list."

This subbasin assessment and TMDL analysis has been developed to comply with Idaho's TMDL schedule. This assessment describes the physical, biological, and cultural setting; water quality status; pollutant sources; and recent pollution control actions in the Big Lost River Subbasin located in south central Idaho (Figure A). The first part of this document, the subbasin assessment, is an important first step in leading to the TMDL. The starting point for this assessment was Idaho's current §303(d) list of water quality limited waterbodies. Nine segments of the Big Lost River Subbasin were listed on this list. The subbasin assessment portion of this document examines the current status of §303(d) listed waters (Table A), and defines the extent of impairment and causes of water quality limitation throughout the subbasin. The loading analysis quantifies pollutant sources and allocates responsibility for load reductions needed to return listed waters to a condition of meeting water quality standards.

Subbasin at a Glance

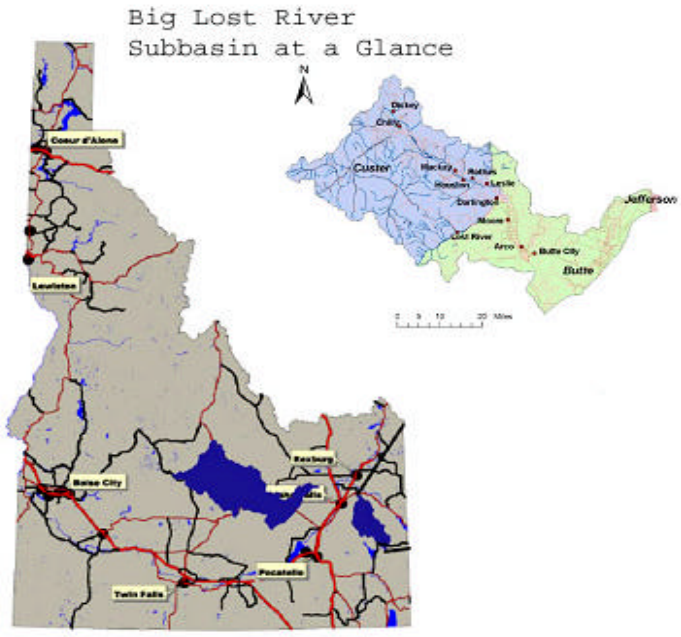

Figure A. Big Lost River Subbasin

Table A. 303(d) listed waters in the Big Lost River Watershed

Waterbody Name	Segment ID Number	1998 §303(d)[1] Boundaries	Pollutants	Listing Basis
Big Lost River	2161	Moore Diversion to Hwy 20	Low Oxygen, Flow Alteration, Excess Nutrients, Excess Sediment, Elevated Temperature	Low SMI, SFI, and SHI scores
Big Lost River	2164	Chilly Buttes to Mackay Reservoir	Nutrients, Sediment	Low SMI, SFI, and SHI scores
Spring Creek	2167	Springs to Big Lost River	Dissolved Oxygen, Flow Alteration, Nutrients, Sediment, Temperature	Low SMI, SFI, and SHI scores
Antelope Creek	2168	Spring Creek to Big Lost River	Flow Alteration, Sediment, Temperature	Low SMI, SFI, and SHI scores
Twin Bridges Creek	2176	Headwaters to Big Lost River	Nutrients, Sediment	Low SMI, SFI, and SHI scores
East Fork Big Lost River	2179	Starhope Creek to Forks	Habitat Alteration	Low SMI, SFI, and SHI scores
East Fork Big Lost River	2180	Headwaters to Starhope Creek	Sediment, Temperature	Low SMI, SFI, and SHI scores
Little Boone Creek	5236	Headwaters to East Fork Big Lost River	Undetermined Pollutants	Low SMI, SFI, and SHI scores
Warm Springs Creek	5237	(Hamilton) Spring to Mackay Reservoir	Undetermined Pollutants	Low SMI, SFI, and SHI scores

[1]Refers to a list created in 1998 of waterbodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

The Big Lost River subbasin of south central Idaho is a watershed isolated from surface connection with the Snake River in Idaho. The Big Lost River watershed is one of four watersheds known in central Idaho as the Sinks Drainages. Surface flow that is not utilized for irrigation sinks, or infiltrates, to groundwater that is conducted in a southwest direction toward the Thousand Springs reach of the Snake River near Hagerman, Idaho where spring flow emerges.

Native fish populations, water quality, and riparian habitat conditions are issues of concern in the subbasin. The cumulative effects of irrigation diversion, alteration of vegetation by grazing in riparian areas, human-caused stream alterations, historic mining practices, roads, residential and municipal development, and past timber harvest have combined to impact water quality and aquatic life in the watershed.

The level of impact is important within the TMDL framework; has beneficial use support been reduced to the point that streams do not support beneficial uses including salmonid spawning or coldwater aquatic life or are these beneficial uses supported at levels that do not require restorative action through a TMDL. If numeric water quality standards are not met then the level of beneficial use support is not factored into determining whether or not a TMDL is required. The issue is not restoration of beneficial uses, but compliance with numeric water quality standards. Production and survival of aquatic species may be limited in some waters but not to the extent that a TMDL is required.

Rainbow trout, cutthroat trout, and brook trout have been documented in the watershed. There is uncertainty as to which, if any species are native to the watershed, however it is felt by some, and not by others that cutthroat trout, mountain whitefish, and bull trout are native. Others feel that only mountain whitefish are native.

Designated Beneficial Uses are listed in Idaho Water Quality Standards for The Big Lost River and include cold water aquatic life, salmonid spawning, primary contact recreation, secondary contact recreation, domestic water supply, and special resource water. Undesignated uses within the Big Lost River Watershed are implied to be supported and are not specifically listed in the State water quality standards. Undesignated beneficial uses include cold water aquatic life and primary and secondary contact recreation for the remainder of the watershed with perennial flow above 1 cfs.

Limited biological assessments at discrete locations conducted by the Idaho Department of Environmental Quality (DEQ) have shown that several streams in the subbasin are water quality limited. Elevated water temperature prevents some streams from meeting water quality standards, and is the primary nonpoint source pollutant of concern. A number of streams that are on the 303(d) list for sediment impairment show full support for salmonid spawning, and cold water aquatic life support status has not been adequately determined through the Beneficial Use Reconnaissance Program (BURP) sampling. Where these streams exceed water quality standards for temperature TMDLs for temperature and sediment have been prepared because the two pollutants are closely related.

Discharge of settleable solids above levels specified in NPDES permits is a specific concern along with temperature exceedence on Warm Springs Creek. Natural and anthropogenic (man-caused) flow alteration has also been identified as the primary source of perturbation in the main Big Lost River subbasin from Chilly Buttes to Mackay Reservoir, and from the Moore Diversion to US Highway 20/26 at Arco, Idaho.

Data has been collected and analyzed to evaluate the water quality limiting issues on the §303(d) list of water quality impaired streams and a number of nonlisted streams within the Big Lost

River watershed. Existing data submitted to DEQ in adequate time for evaluation was also used to assess water quality.

Three wasteload allocations were prepared for point source discharges within the Big Lost River subbasin. Two hatcheries on Warm Springs Creek received four waste load allocations that reduce discharge of settleable solids from their effluent and allocate effluent temperatures to not exceed water quality standards. The City of Mackay receives a waste load allocation that reflects the draft NPDES permit for discharge from the Waste Treatment Facility that is currently under review.

Twelve Total Maximum Daily Loads (TMDLs) have been developed to address issues of temperature exceedence of water quality standards on eleven streams (two segments on Antelope Creek). Sediment TMDLs have been prepared for the streams with temperature exceedence with the exception of Warm Springs Creek and the main Big Lost River from its origin at the confluence of the North and East Forks of the Big Lost River to Chilly Buttes. Warm Springs Creek is covered under the Waste Load Allocation and has a temperature TMDL. Sediment TMDLs were prepared for two additional streams that did not have sufficient temperature date to determine a TMDL for thermal loading; Twin Bridges Creek and Thousand Springs Creek. Table B provides a summary of the TMDLs developed for the Big Lost River subbasin.

Table B. Streams and pollutants for which TMDLs were developed.

Stream	TMDL Pollutant(s)
East Fork Big Lost River	Sediment, Temperature
Corral Creek (East Fork Big Lost tributary)	Sediment, Temperature
Starhope Creek	Sediment, Temperature
Wildhorse Creek	Sediment, Temperature
North Fork Big Lost River	Sediment, Temperature
Summit Creek	Sediment, Temperature
Big Lost River: Source to Chilly Buttes	Temperature
Twin Bridges Creek	Sediment
Thousand Springs Creek	Sediment
Warm Springs Creek	Temperature
Antelope Creek	Sediment, Temperature
Bear Creek	Sediment, Temperature
Cherry Creek	Sediment, Temperature

TMDLs for sediment are quantified through streambank erosion inventories. Sediment loading targets were developed based on the assumption that 80% streambank stability is an attainable natural condition described in frequency distributions developed in central Idaho by land management agencies. This is a conservative assumption and gives a margin of safety adequate to assure adequate sediment reduction and channel geometry that reduces thermal loading. Irrigation return flow to surface waters was not identified as a significant source of sediment because there is little flow that returns to surface waters. Hill slope erosion is assumed to be within the range of natural background in relation to affected streams. Sediment loading from

irrigated cropland does not occur in areas where sediment loads are identified as limiting beneficial use support or is not identified as a significant source of sediment in relation to the impact of flow alteration. In the language of Anti-Degradation legislation the allocation becomes the current load.

Targets for substrate sediment are adopted from land management agency targets derived from goals established in monitoring plans intended to guide management of public lands to improve salmonid egg and fry survival. Target values established in this assessment will be used to indicate trends related to channel morphology and streambank recovery. Beneficial use support status and compliance with state water quality standards will be used to determine the need for additional best management practices to improve water quality.

Temperature TMDLs have been developed for streams where temperature data has been collected and shows exceedence of temperature criteria in greater than 10% of observation days during spring or fall spawning periods. Thermograph data established that temperature TMDLs were necessary to meet the numeric salmonid spawning criteria [IDAPA 58.01.02.250(02)]. Temperature TMDL load reductions were developed by quantifying the maximum temperature exceedence for data collected during spring and fall spawning periods and subtracting that from the spawning temperature criteria to formulate the load reduction (allocation). The margin of safety factored into temperature TMDLs is implicit because the highest temperature recorded is the basis for the TMDL. Table B also summarizes the streams that have had temperature TMDLs developed.

Sediment TMDLs are intended to support a reduction in temperature loading and are based on 80% streambank stability. This proportion of streambank stability is assumed to be at average natural background conditions and would result in improved channel geometry and riparian vegetation to reduce sediment and thermal loading. Cold water aquatic life and salmonid spawning are expected to be fully supported at 80% streambank stability within the watershed. The margin of safety for sediment TMDLs is implicit.

Instream sediment targets have been identified from literature values that are supportive of salmonid spawning and cold water aquatic life. These target values are set at 28% fine sediment less than 6.35 mm (1/4 in.) in diameter in spawning habitat. Monitoring of instream sediment targets over the implementation period will be used to track the effectiveness of management practices and may be used to indicate the need for additional or more effective best management practices to improve water quality in the Big Lost River subbasin.

Reduced riparian vegetation contributes to accelerated streambank erosion, which results in increased sediment and thermal loading which, combined with associated changes in channel morphology due to sediment deposition, are the primary causes of temperature loading in affected streams.

Streams listed as having altered flow have been determined to be flow altered for significant periods of the year. Altered flow is not a pollutant as defined by the Clean Water Act (CWA) Section 502(6). Since TMDLs are not required to be established for waterbodies impaired by effects other than pollutants, TMDLs will not be developed for flow-altered streams. They will

be listed in categories on the Integrated Report that reflect that they are primarily affected by flow alteration.

There are nine 303(d)-listed stream segments on 6 waters in the Big Lost River subbasin. Below is a tabular description of the issues related to the listed stream segments and the disposition of that stream segment according to categories described in the 2002 Water Body Assessment Guidance for Idaho (Table B).

A summary of temperature TMDL load reductions is shown in Table C. Elevated stream temperature is tied to streambank erosion related to reduction in density diversity and vigor of riparian vegetation. The load reduction is based on the highest observed temperature exceedence during the salmonid spawning period. The exceedence used could have occurred during the spring or fall spawning period. Only two accumulated days data during this period is required to establish a minor exceedence of water quality criteria.

Table C. Summary of assessment outcomes for listed streams and TMDL streams in the Big Lost River subbasin.

Waterbody Segment	Assessment Unit of HUC 17040218	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
Big Lost River (WQLS 2161) Moore Diversion to Hwy 20/26	SK002	Low Oxygen, Flow Alteration, Excess Nutrients, Excess Sediment, Elevated Temperature	No	List for Flow Alteration, remove from list for other pollutants	Flow Altered (Natural and Anthropogenic)
Big Lost River (WQLS 2164) Chilly Buttes to Mackay Reservoir	SK015	Excess Nutrients, Excess Sediment	No	List for Flow Alteration, remove from list for other pollutants	Flow Altered (Natural and Anthropogenic
Spring Creek (WQLS 2167) Springs to Big Lost River	SK003	Dissolved Oxygen, Flow Alteration, Nutrients, Sediment, Temperature	No	List for Flow Alteration, remove from list for other pollutants	Flow Altered (Natural and Anthropogenic
Antelope Creek (WQLS 2168) Spring Creek to Big Lost River	SK046	Flow Alteration, Sediment, Temperature	Yes: Sediment, Temperature	List for Flow Alteration from Lower Diversion to Big Lost River, list for sediment and temperature from Forest Boundary to Lower Diversion	TMDL Developed

Twin Bridges Creek (WQLS 2168) Headwaters to Big Lost River	SK026_03	Nutrients, Sediment	Yes: Sediment	List for sediment remove from list for other pollutants	TMDL Developed
East Fork Big Lost (WQLS 2180) Headwaters to Cabin Creek	SK039	Sediment, Temperature	Yes: Sediment, Temperature	List for sediment and temperature	TMDL Developed
East Fork Big Lost (WQLS 2179) Cabin Creek to Mouth	SK033	Habitat Alteration	Yes: Sediment, Temperature	List for sediment and temperature	TMDL Developed
Little Boone Creek (WQLS 5236) Headwaters to East Fork Big Lost	SK033_02	Undetermined Pollutants	No	Listed in error. Remove from list: flow less than 1 cfs	Flow Altered (Natural and Anthropogenic)
Lead Belt Creek (WBID US58) Source to Antelope Creek	SK058	Temperature	No	Listed in error. Remove from list: flow less than 1 cfs	Flow Altered (Natural and Anthropogenic)
Warm Springs Creek (WQLS 5237) Hamilton Spring to Mackay Reservoir	SK043	Undetermined Pollutants	Yes: Temperature, NPDES Waste Load Allocation	List for temperature	TMDL Developed
Big Lost River (WBID US24) Forks to Chilly Buttes	SK024	Temperature	Yes: Temperature	List for temperature	TMDL Developed
Thousand Springs Creek (WBID US16) Chilly Slough to Big Lost River	SK016	Sediment	Yes: Sediment	List for sediment	TMDL Developed
Corral Creek (WBID US41) Coyote Creek to East Fork Big Lost River	SK041	Sediment, Temperature	Yes: Sediment, Temperature	List for sediment and temperature	TMDL Developed
North Fork Big Lost River (WBID US27) Zipper Creek to Forks	SK027	Sediment, Temperature	Yes: Sediment, Temperature	List for sediment and temperature	TMDL Developed

Summit Creek (WBID US28) Phi Kappa Creek to Mouth	SK028	Sediment, Temperature	Yes: Sediment, Temperature	List for sediment and temperature	TMDL Developed
Bear Creek (WBID US53) Right Fork to Mouth	SK053	Sediment, Temperature	Yes: Sediment, Temperature	List for sediment and temperature	TMDL Developed
Cherry Creek (WBID US49) Forest Boundary to Mouth	SK049	Sediment, Temperature	Yes: Sediment, Temperature	List for sediment and temperature	TMDL Developed
Starhope Creek (WBID US35) Muldoon Creek to East Fork Big Lost	SK035	Sediment, Temperature	Yes: Sediment, Temperature	List for sediment and temperature	TMDL Developed
Wildhorse Creek (WBID US30) Fall Creek to Mouth	SK030	Sediment, Temperature	Yes: Sediment, Temperature	List for sediment and temperature	TMDL Developed

An exceedence of 10% of observation days is required to constitute a major exceedence. A summary of sediment load reductions in support of temperature TMDLs is shown in Table D. Load reductions are derived from the current load estimation taken from the expected sediment load that would occur at approximately 80% streambank stability. Where negative numbers appear, as in the case of Warm Springs Creek, over 80% streambank stability is estimated. Warm Springs Creek is covered under a wasteload allocation as a point source operating under an NPDES permit issued by EPA. Where erosion rates were calculated based on multiple samples the Existing Erosion Rate and Total Erosion Rate show Composite in Table D.

Table D. Temperature TMDL load reductions for streams in the Big Lost River Watershed.

Stream	Temperature Statistic	Highest Recorded Temperature (Current Load)	Criteria (Loading Capacity)	Load Reduction (Degrees C)	% Reduction
East Fork Big Lost River	Max Daily	21.3	13°C	-8.3	39.0
	Daily Ave	15.2	9°C	-6.2	40.8
Corral Creek	Max Daily	21.7	13°C	-8.7	40.1
	Daily Ave	14.39	9°C	-5.39	37.5
Starhope Creek	Max Daily	20.6	13°C	-7.6	36.9
	Daily Ave	13.6	9°C	-4.6	33.8
Wildhorse Creek	Max Daily	16.7	13°C	-3.7	22.2
	Daily Ave	11.33	9°C	-2.33	20.6
North Fork Big Lost River	Max Daily	19	13°C	-6	31.6
	Daily Ave	12.92	9°C	-3.92	30.3
Summit Creek	Max Daily	17.8	13°C	-4.8	27.0
	Daily Ave	11.6	9°C	-2.6	22.4
Big Lost River at Howell Ranch	Max Daily	14.6	13°C	-1.6	11.0
	Daily Ave	11.1	9°C	-2.1	18.9
Warm Springs Creek	Max Daily	20.9	13°C	-7.9	37.8
	Daily Ave	14.5	9°C	-5.5	37.9
Antelope Creek at Forest Boundary	Max Daily	19	13°C	-6	31.6
	Daily Ave	13.86	9°C	-4.86	35.1
Antelope Creek at Diversion	Max Daily	23.2	13°C	-10.2	44.0
	Daily Ave	15.1	9°C	-6.1	40.4
Cherry Creek	Max Daily	18.68	13°C	-5.68	30.4
	Daily Ave	16.47	9°C	-7.47	45.4
Bear Creek	Max Daily	19.4	13°C	-6.4	33.0
	Daily Ave	14.15	9°C	-5.15	36.4

Table E. Erosion load allocations for Big Lost River subbasin.

Stream	Estimated Current Load		Load Capacity/Load Allocation		Reductions		
	Existing Erosion Rate (t/mi/yr.)	Total Erosion (t/yr.)	Erosion Rate (t/mi/yr.)	Total Erosion (t/yr.)	Total Erosion Reduction (t/yr.)	Total Erosion Rate Reduction (t/mi/yr.)	Total Erosion % Reduction to Meet Load Capacity
East Fork Big Lost River	Composite	1218	---	172	1046	Composite	85.9
Corral Creek	36	250	6.0	39	211	30	84.4
Starhope Creek	26	249	7.0	69.0	180	19	72.3
Wildhorse Creek	21	103	6.0	28.5	74.5	15	72.3
North Fork Big Lost River	Composite	285	---	54.3	230.7	Composite	80.9
Summit Creek	11	45	4	14.0	31	7	68.9
Twin Bridges Creek	115	536	7	33.1	502.9	108	93.8
Thousand Springs Creek	10	13	3	3.5	9.5	7	73.1
Warm Springs Creek	Composite	12.8	---	26.6	-13.8	Composite	-107.8
Antelope Creek	Composite	888	---	118	770	Composite	86.7
Bear Creek	11	52	4.0	17.0	35	7	67.3
Cherry Creek	Composite	156	---	53.2	102.8	Composite	65.9